ECONOMIC DEVICE SYSTEM FOR EXTRACTING THE DUST AND AEROSOLS FROM THE ATMOSPHERE OF THE PERMANENT LUNAR OR MARTIAN BUILDINGS. T. Földi[1], Sz. Bérczi[2] [1]FOELDIX, H-1117 Budapest, Irinyi J. u. 36/b. Hungary, [2]Eötvös University, Institute of Physics, Cosmic Materials Space Research Gr. H-1117 Budapest, Pázmány P. s. 1/a, Hungary, (bercziszani@ludens.elte.hu)

Summary: Any movement activities amplify the natural levitating dust during the lunar days and generate dust in the Martian atmospheric conditions. For permanent planetary bases we propose an economic device, arrangement solution for the dust extraction by a dust-coagulator type instrument system arranged locally and working without moving parts.

Introduction: Measurements of the Surveyor landers and Apollo 17 LEAM experiments indicated a levitating lunar dust cloud above the lunar surface [1-3]. This ionized dust cloud is generated mainly by solar UV radiation [4]. Recently MER rovers on site observed dust devils frequently appearing in the Martian environment [5]. Dust devils transport dust locally, dust storms distribute and move dust globally. In the MPF and MER missions the continuous sedimentation of the fine Martian dust were also observed [6]. Both lunar and Martian permanent bases need solution for the continuous dust transport, because the presence of planetary dust is obstructive for measurements inside the lunar base.

Experiment: Earlier we studied the formation of the levitating lunar dust [7] which forms a transient quasiatmosphere in the lunar environment [8]. We modeled the electrostatic mechanisms of the lunar (and planetary) dust in our experimental arrangement and we concluded that charged dust particles can coagulate if they are charging with + and – charges alternates. Not only receiving but loosing charges helped the coagulation of aerosol particles. We found that if dust particles cover a longer interval in this alternating charging process then the electrostatically charged dust particles may form larger and larger grains. The coagulating grains may also attract and include H_2O molecules. The process of coagulation can be promoted by very small additional H_2O molecules, which help growing larger the dust clusters [8].

Instrument: As a consequence of the recognitions of the electrostatic charging and coagulation process we suggest a device system for permanent dust-extracting from the air of the lunar/Martian base. The coagulating process can be built into a collector chamber which not only extracts and coagulates dust particles but also keep in motion the atmosphere inside the lunar base without moving machine parts. A chamber with 2000 X 1000 X 250 millimeters volume (1 bar) and two systems of electrodes were arranged in the chamber, and were operated on + 15 kV and - 15 kV potential, respectively (the power supply was varied between 8 kV to 15 kV). Opened to the free air, the gas began to move through the instrument, by getting constant velocity of 1 meter/s [9].

Experiment with the instrument: We studied the production of coagulated dust particles in an electrostatic experiment [8-9]. In this work we used a chamber in the column-arrangement of the instrument - open up and down - on the bottom of the tube the coagulated particles dropped. They had quasi-spherulitic form and getting through 20 electrodes the maximal mass of the coagulated particles was 540.000. times that of the initial molecular mass [9, 10]. We observed that the addition (evaporation) of negatively charged water molecule-ions to the atmosphere the coagulated particles can grow larger. Water molecules help coagulation because they are small negative ions and have far longer lifetime then that of the small positive ions [8, 10].

Laboratory measurements of effectivity: The device was tested between two isolated rooms, which were connected through only a window, where the dust coagulator FOELDIX device was placed with airflow insulation (to exclude the air transport outside of the instrument). In Room-1 standard bacteria aerosol injector polluted the room by a given amount of bacteria. The concentration of the pollution was measured by nutrients placed in Petrie-dishes, in Room-2. The experiment was repeated with various bacteria. The effectivity of the bacteria filtering of FOELDIX was better then 0.99 [11].

Benefits of the aerosol coagulator device: Recent terrestrial solutions for dust extracting in a building works with centralized system. Instead of it our proposal for lunar/Martian base rooms a distributed unit system is used with local air cleaner units. The centralized system has ca. 20-50 times larger mass and 10 times larger energy request as compared our proposed distributed cleaner units system.

Conclusion: The dust-coagulating FOELDIX device system effectively collects the dust and other aerosols down to the fine 1/100 micrometer size range in lunar/Martian bases.

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